

## Health Care Provider Hemoglobinopathy Fact Sheet

# Hemoglobin S

**Hemoglobin S** is an inherited variant of normal adult hemoglobin (hemoglobin A). It results from a substitution of valine for glutamic acid in the sixth position of the  $\beta$  globin chain. The gene for Hemoglobin S has the highest frequency among people of African heritage (about 1 in 10). However, it is also found in people of Hispanic and Mediterranean (Italian, Greek, Turkish) descent. Summarized below are the four most commonly encountered hemoglobin patterns that involve hemoglobin S.

### **Hemoglobin S Trait** (phenotype: FAS in infants and AS in adults)

Commonly known as sickle cell trait, hemoglobin S trait results when the gene for hemoglobin S is inherited from one parent and a hemoglobin A gene from the other. This carrier state does not result in health problems, although episodes of microscopic hematuria may be noted in some individuals. Other manifestations are rare and associated with conditions of extreme hypoxia. For an infant identified with hemoglobin S trait on two newborn screening specimens, no further testing is indicated for the child. However, it is strongly recommended that the parents have hemoglobin testing. This can determine if they may be at risk for having subsequent children with a clinically significant form of hemoglobin S (described below), as the sickle cell syndromes are inherited in an autosomal recessive fashion.

### **Homozygous Sickle Cell Disease** (phenotype: FSS in infants and SS in adults)

Commonly referred to as sickle cell anemia, homozygous sickle cell disease results when the gene for hemoglobin S is inherited from both parents. A moderate to severe hemolytic anemia develops in the first few months of life as the amount of fetal hemoglobin decreases and hemoglobin S increases. Infants and children with sickle cell disease are particularly susceptible to bacterial infections and splenic sequestration, each of which can result in death. Prophylactic oral penicillin and folic acid should be started before three months of age and maintained through age six to decrease the morbidity and mortality associated with the disease. Some long-term manifestations of homozygous sickle cell disease are recurrent pain episodes and tissue infarction with organ damage and failure.

### **Hemoglobin Sickle C Disease** (phenotype: FSC in infants and SC in adults)

Compound heterozygotes with hemoglobin sickle C disease result when the gene for sickle hemoglobin is inherited from one parent and the gene for hemoglobin C from the other. In general, the clinical manifestations of hemoglobin SC disease are very similar to homozygous sickle cell disease. Some notable differences are a higher risk for splenomegaly, retinal disease and aseptic necrosis.

### **Sickle/ $\beta$ Thalassemia** (phenotype: FSA or FS<sup>-</sup> in infants and SA or S<sup>-</sup> in adults)

Co-inheritance of the gene for hemoglobin S and beta thalassemia, termed sickle/ $\beta$  thalassemia, has a wide range of clinical manifestations ranging from mild to very severe, depending upon the degree of the thalassemia affecting the hemoglobin A gene. Individuals with sickle/ $\beta^0$  thalassemia have a very severe disease essentially identical to homozygous sickle cell anemia. Most individuals with sickle/ $\beta^+$  thalassemia have fewer problems with infections and spleen involvement, fewer pain episodes, and less organ damage.

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*Genetic counseling is advisable for families affected by these conditions to promote understanding of the significance for themselves and future offspring. A list of genetic counselors and hemoglobin consultants was included with this fact sheet (additional copies are available from our office).*

